

# IMPERIAL

## Security & Resilience Summer School

*Discover the science and cutting-edge technologies that underpin global security and resilience.*

**21<sup>st</sup> July to 1<sup>st</sup> August 2025 at Imperial College London**



### IMPERIAL COLLEGE LONDON AND ISST

Consistently rated amongst the world's best universities (3<sup>rd</sup> in Europe and 6<sup>th</sup> in World, QS World University Rankings 2023), Imperial College London is a science-based institution with an international reputation for excellence in teaching and research. Imperial attracts over 22,000 students and 8,000 staff of the highest international quality from over 126 different countries.

Since its foundation in 1907, Imperial's contributions to society have included the discovery of penicillin, the development of holography and the foundations of fibre optics. This commitment to the application of research for the benefit of all continues today, with current areas of focus including interdisciplinary collaborations to improve global health, tackle climate change, develop sustainable sources of energy, address security challenges, develop data management and analysis technologies for supporting data driven research, and tackling problems at molecular scale.



The **Institute of Security Science and Technology (ISST)** is a major Imperial College London initiative that brings together Imperial's existing security science activities and expertise and provides a focus and a catalyst to challenge that perception and demonstrate

the breadth and depth of a topic that touches everyone in society, wherever they are in the world.

Individuals, organisations and nations experience insecurity in diverse ways, ranging from scarcity of water, nutrition and natural resources through to economic hardship, political instability, health crises and exposure to hostile threats from criminals, terrorists and nation states. Our goal is to understand and solve these complex, interrelated global challenges through the development and application of world-leading science and technology; a hallmark of Imperial College London.

As our societies and infrastructures become ever more interconnected, slow formulaic security reactions will need to give way to predictive analysis, agility and continual learning. In an imperfect socio-technical world, we believe that science and technology guided by the values of inclusivity, stability, peace and equity for all, as described by the UN Sustainable Development Goals, is the best way to strive for global security and that these values are worth defending.

As humanity extends its presence beyond the surface of the planet, moves towards the birth of true artificial intelligence and harnesses the quantum scale, we are committed to working with the best minds from academia, industry and government who share our view that science and technology can deliver a more secure and resilient world for everyone.

## **SUMMER SCHOOL OVERVIEW**

Security and Resilience are of increasing importance on a world basis. The importance of secure cyber, cyber-physical and physical protection coupled with an increased awareness and importance of deep-rooted societal and organisational resilience will be the hallmarks of the post-COVID world. The major changes experienced from the early 1980's where electronic and information technologies gained widespread public access to the small handheld computers, Apps, Internet of Things of the present day are truly breath-taking. The growth in speed, interconnectivity and access to information is unprecedented. Globalisation and liberalisation of markets and movement of people has further changed the societal landscape.

Resilience can be defined as the ability of a society and its organisations to accommodate 'stress' through an understanding of risk. Societal stress can arise due to changes in natural environment, political unrest, physical threat, financial crisis and information leakage. In general security is used to mitigate and remove threat to vital societal structures, both physical and psychological.

This summer school programme has been designed and developed in line with the research and innovative activities of the Institute of Security Science and Technology (ISST): Areas such as space, environmental security, transportation, and cyber threats, the programme will also cover 'traditional' areas such as physical environment and physical threat as well as equipping students with a range of core skills applicable across industry, government and academic sectors.

This summer school is designed for undergraduate students studying across all disciplines and degrees, with a keen interest in security science and resilience. Students will be introduced to key concepts, develop an understanding of security and resilience, hear from experts on the applications of security science and technology and work in teams towards a project.

Topics covered include:

- Security & Resilience: Science and Technology Fundamentals
- Cyber security systems
- Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE)
- Sensors and Detection
- Emerging and Disruptive Technology (EDTs)
- Behavioural Security Science
- Infrastructure and Transport Security
- Security of Space

### **Team learning through scenario-based group project:**

Students will be working in small teams on a scenario-based group project, presented with a security risk/threat the groups will be expected to discuss and understand the following –

- i. how and why threat/activity occur,
- ii. what relevant controls and aspects of security and resilience were in place,
- iii. how the situation is controlled,
- iv. the failures and oversights,
- v. effective mitigation
- vi. and overall societal impact.

Supervised by Imperial academics throughout the programme, students will present the project findings to a panel of experts on the last day of the programme.

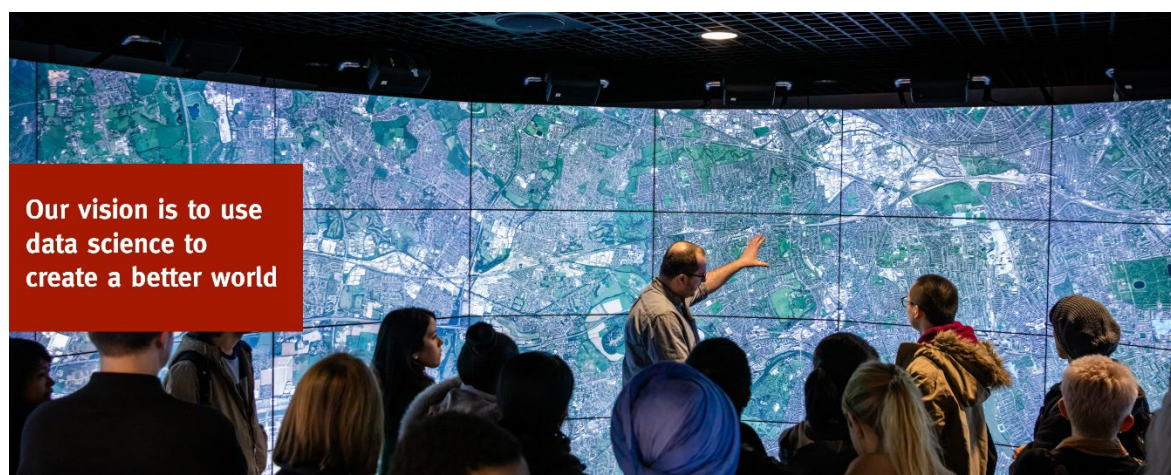
### **Learning objectives:**

On completion of this summer school, students will be able to understand, define and place in the wider societal context:

- Who and what are the main security threats and risks across a range of sectors
- The main physical threats, detection and mitigation measures in key sectors
- The specific vulnerabilities of electronic infrastructure, cyber presence, communication networks
- Common threats and mitigation measures across all sectors
- The behaviour of humans and threat actors
- Establish an understanding of data visualisation and see how this is presented in the state-of-the-art 360 observatory;
- Understand the importance of research ethics and ethics of digital technologies
- Develop valuable professional skills in teamwork, communication and presentation;
- Experience team-based learning through a group project;
- Practice and improve their English language.

In addition, students will have an opportunity to make new friends, get to know student ambassadors from Imperial College London through social activities and discuss opportunities for future study and experience what it is like to study in a world class university.

## Visit to the Data Science Institute



As part of this summer school, students will have a unique opportunity to visit the state-of-the-art 360 Observatory at the Data Science Institute, one of the seven Global Institute at Imperial College London, and see demonstrations of cutting edge data science research.

## PROGRAMME STRUCTURE AND FORMAT

60 contact hours spread over 2 weeks covering lectures, workshops, tutorials, project work, social activities and relevant visit. Classes will be delivered on weekdays.

Students will be allocated in small groups for Project work which will be done through team-based learning with supervision. Final project will be presented in groups to a panel of experts on the last day of the programme. A prize will be awarded to the team with the best project.

The entire programme will be taught in English.

## SESSIONS DESCRIPTION

### **Security & Resilience: Science and Technology Fundamentals**

Day 1 will provide an overview to Security and Resilience, the session will bring together technical, engineering and science aspect, contextualising the breadth and depth of the security threats and challenges we face and how science and technology can deliver a more secure and resilient world.

### **Cyber Security: Cyber threats**

This session will introduce the core concepts and challenges of cyber security and cyber-physical security (CPS), the current state of the art, providing an overview of computer networks and cyber security fundamentals and risks, the characteristics of CPS systems and security and privacy concerns of IoT devices.

### **Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE)**

The aim will be to provide students with an understanding of the history and threat posed by a wide variety of devices, agents and biological entities with an introduction to the underlying science of CBRNE, focusing on hazards, detection, protection and impacts and effects on real-world environments.

### **Sensors and Detection**

The students will have an opportunity to explore the principals of detection and sensor systems, understand the importance of electronic systems (smart sensors, wireless sensors and micro technologies) with an overview of natural sensing system and detection.

### **Emerging and Disruptive Technology (EDTs): Machine Learning and AI**

The development of the internet over the last few decades has resulted in an increase in the production of data and the unprecedented availability of computing power for business applications. These sessions will look at large scale data processing, AI and Machine Learning in security context.

### **Behavioural Security Science**

The sessions will focus will be the scientific study of human behaviours and the need to understand human actors at every level – be they the perpetrators of criminal or terrorist acts, the victims, or the decision makers who work in security setting and their possible motivations and research ethics of behavioural research.

### **Smart Cities: Transport and Infrastructure**

This session will focus on smart and sustainable cities, key elements of a smart city and the infrastructure and interdependencies, the security of critical national infrastructure (CNI), security vulnerabilities of transport systems and the threat to the security of transportation of people and goods.

### **Security of Space**

Day 8 will focus on the threats on space technology, understanding the source of the threats and the role of security policy makers alongside engineers in the exploration, development and settlement of space. The second session of the day will focus on Space and Resilience.

### **Global Security Challenges**

The final aspect of the programme will focus on Global Security Challenges and understanding the extent of interrelated global security challenges across key sectors including building resilience in healthcare, energy and environmental security.

## **ENTRY REQUIREMENTS**

All students are expected to be studying an undergraduate degree, preferably in the final two years of their undergraduate studies, in any subject discipline.

### **English requirements:**

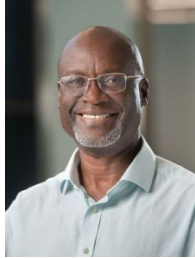
All students are required to have a good command of English, and if it is not their first language, they will need to satisfy the College requirement as follows:

- a minimum score of IELTS (Academic Test) 6.5 overall (with no less than 6.0 in any element) or equivalent.
- TOEFL (iBT) 92 overall (minimum 20 in all elements)
- CET- 4 (China) minimum score of 550
- CET- 6 (China) minimum score of 520

Students will be asked to bring along their computer for project work.

## TEACHING FACULTY

The summer school is Academic Director is Professor Washington Ochieng



**Professor Washington Ochieng**, Interim Director of the Institute for Security Science and technology.

Professor Ochieng is also the Head of the Department of Civil and Environmental Engineering and Chair in Positioning and Navigation Systems at Imperial College London.

The programme will be taught by a multi-disciplinary teaching faculty from the Institute of Security Science and Technology <https://www.imperial.ac.uk/security-institute/about-us/faculty-and-security-science-fellows/> and other departments of Imperial College London.



**Dr William Proud**

Bill is Reader in Shock Physics at the Department of Physics, and a Security Science Fellow at the Institute. His main research interest is into high strain rate properties of a wide range of materials, both inert and energetic. Bill is the academic course director for the MSc Security and Resilience course

**Dr Mireille Elhajj**

Dr Elhajj is a Visiting Associate Professor at Imperial College London, Co-lead of the ISST Infrastructure and Transport Security Module, the Founder and CEO of Astraterra a consultancy based in London specializing in smart cities and mobility solutions; and positioning, navigation, and timing (PNT) systems design and applications. Dr. Elhajj is a fellow of the Royal Institute of Navigation (AFRIN).



**Jane Lac**

Jane is the ISST Operations Director, she has overall responsibility for the operational and financial management of the Institute. She is responsible for financial planning, the implementation of the Institute's strategy against its mission, the development of its education portfolio, and leads on the Security and Resilience MSc as Co-Director.

## **CERTIFICATION**

Students will receive a verified Imperial College London certificate on successful completion of the summer school and a prize will be awarded to the best project team. Each student will also receive a document with their project marks.



## LOCATION

The summer school will take place at Imperial College London's South Kensington Campus, located amongst many famous [attractions](#) in London.

The culture triangle: neighbour to three of London's most prestigious (and free) museums. Right next door, the Science Museum. Across the road, the Victoria & Albert Museum, and around the corner? The Natural History Museum. From Neolithic to the latest scientific breakthroughs, experience it all just minutes from Imperial's doorstep.

The campus is also next to the famous Royal Albert Hall, one of London's most iconic music venues, established in 1871, host to the BBC Proms and countless world-famous international artists.

In addition, the beautiful Hyde Park and the famous Harrods Department Store are just a short walk from the campus.



Organised by the Institute of Extended Learning, Professional Development & Summer Programmes unit, in collaboration with the Institute of Security Science and Technology at Imperial College London.